

CLAIMS

1. Micro-system intended to receive beads and to obtain a precise positioning of said beads at preset locations in the micro-system, characterised in that it comprises:

- 5       - a tank (3) that has a cavity (4), said cavity (4) being fitted with blocking elements (5, 15, 25, 35) that allow the beads (2, 12, 22, 32a, 32b) to be ordered and stacked in the interstices (6, 16, 26, 36) between the blocking elements (5, 15, 25, 35), the  
10 interstices (6, 16, 26, 36) constituting said preset locations,
- a cap (7) hermetically sealing the tank (3),
- and import means (8) and output means (9) allowing a fluid to flow in the cavity (4).

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2. Micro-system according to claim 1, characterised in that the blocking elements (5, 15, 25, 35) consist of columns that are integral with the bottom of the cavity or the cap.

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3. Micro-system according to claim 1, characterised in that, the beads (2, 12, 22) all having the same diameter, the blocking elements (5, 15, 25) are evenly arranged in a two-dimensional network.

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4. Micro-system according to claim 1 or 2, characterised in that, the micro-system (1) having to receive beads (32a, 32b) of different diameters, the blocking elements (35) are distributed so as to obtain

a positioning of the beads (32a, 32b) as a function of their diameters.

5        5. Micro-system according to claim 4,  
characterised in that the blocking elements (35) are distributed so as to constitute wells intended to receive beads (32a) of a first preset diameter and spaces between the wells intended to receive beads (32b) of a second preset diameter.

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6. Micro-system according to claim 3, characterised in that the two-dimensional network is a hexagonal mesh.

15       7. Micro-system according to claim 3, characterised in that the two-dimensional network is a square mesh.

20       8. Micro-system according to any one of the previous claims characterised in that the blocking elements (5, 15, 25, 35) have a transverse cross-section of a shape selected from among discs, ellipses and polygons.

25       9. Micro-system according to claim 8, characterised in that the blocking elements (5, 15, 25, 35) have a transverse cross-section in the shape of a hexagon.

30       10. Micro-system according to any one of the previous claims characterised in that the blocking

elements (5, 15, 25, 35) are of a height that allows at least two beads to be stacked.

11. Micro-reactor including a micro-system  
5 according to any one of claims 1, 2, 3, 6 to 10 and beads (2, 12, 22) of one and the same diameter and with the same function, fitted between the blocking elements (5, 15, 25).

10 12. Micro-reactor including a micro-system according to any one of claims 1, 2, 3, 6 to 10 and beads (2, 12, 22), of the same diameter but functionalised differently, fitted between the blocking elements (5, 15, 25).

15 13. Micro-reactor including a micro-system according to any one of claims 1, 2, 4, 5, 8 to 10 and beads (32a, 32b), with the same function but of different diameters, fitted between the blocking  
20 elements (5, 15, 25, 35).

14. Micro-reactor including a micro-system according to any one of claims 1, 2, 4, 5, 8 to 10 and beads (32a, 32b), of different diameters and functions,  
25 fitted between the blocking elements (5, 15, 25, 35).

15. Process for making a micro-system according to any one of claims 1 to 10, said process comprising the following stages:

- forming, by micro-machining a substrate (41), the tank that has the cavity fitted with the blocking elements (45),

- supplying a cap (7) intended to seal the cavity  
5 (4) of the tank (3) hermetically,

- forming the fluid import means (8) and output means (9) by micro-machining the tank (3) and/or cap (7).

10 16. Process according to claim 15, wherein the micro-machining is carried out by a process of dry or wet etching a material.

15 17. Process according to claim 15, wherein the micro-machining is carried out by impression moulding process.

20 18. Process according to claim 15, wherein the micro-machining is carried out by photolithography process.

25 19. Process for obtaining the micro-reactor according to claim 11, said process comprising a stage of sedimentation filling with functionalised beads in suspension in a liquid.

30 20. Process for obtaining a multi-functional micro-reactor by filling the micro-system, according to claim 3, with functionalised beads of one and the same diameter but with different functions, characterised in that said process includes:

- for beads functionalised according to a first function, the following stages:

a) placing a cover on the micro-system tank (3) leaving accessible the part in which it is wished to place the beads of a first function,

b) filling by sedimentation,

c) withdrawing the cover (7),

- for beads functionalised according to another function, the repetition, as many times as there are functions remaining, of stages a) to c) with beads of said other function,

- sealing the tank (3) with the cap (7).

21. Process for obtaining a multi-functional micro-reactor by filling the micro-system, according to one of claims 4 or 5, with beads the function of which is related to the diameter of said beads, characterised in that said process includes at least two filling stages, the order of the filling stages corresponding to the decreasing order of the diameter of the beads.

22. Process for implementing a biochemical or biological reaction wherein a fluid stream is made to flow in a micro-reactor according to any one of claims 11 to 13, so that at least one constituent of said fluid stream reacts with the pre-functionalised beads (2, 12, 22, 32a, 32b) able to produce a chemical, electrochemical, biological or biochemical reaction, and at the micro-reactor output(s) a fluid stream is collected that includes the product(s) of said reaction.

23. Process according to claim 22, wherein said reaction is a reaction of the substrate enzyme type, said pre-functionalised beads (2, 12, 22, 32a, 32b) able to produce a biological or biochemical reaction are enzymes, said constituent of the fluid stream is a substrate of the enzyme and the products of the reaction are the products arising from the reaction of said enzyme with said substrate.

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24. Process according to claim 22, wherein said reaction is an enzymatic digestion reaction by a protease, said pre-functionalised beads (2, 12, 22, 32a, 32b) able to produce a biological or biochemical reaction are proteases and said constituents of the fluid stream are peptides or proteins and the products of the reaction are peptidic segments.

25. Process according to claim 24, wherein the enzyme is trypsin.

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